Scientific Inquiry

7-1 The student will demonstrate an understanding of technological design and scientific inquiry, including the process skills, mathematical thinking, controlled investigative design and analysis, and problem solving.

7-1.1 Use appropriate tools and instruments (including a microscope) safely and accurately when conducting a controlled scientific investigation.
Taxonomy Level: 3.2-B Apply Conceptual Knowledge

Previous/Future knowledge: In previous grades, students used magnifiers and eyedroppers (K-1.2), rulers (1-1.2), thermometers, rain gauges, balances, and measuring cups (2-1.2), beakers, meter tapes and sticks, forceps/tweezers, tuning forks, graduated cylinders, and graduated syringes (3-1.5), a compass, an anemometer, mirrors, and a prism (4-1.2), a timing device and a 10x magnifier (5-1.4), and a spring scale, beam balance, barometer, and sling psychrometer (6-1.1) safely, accurately, and appropriately. In future grades, students will use these tools when appropriate as well as learn new tools to use when collecting scientific data. A complete list of tools can be found in Appendix A of the Academic Standards.

It is essential for students to know that different instruments or tools are needed to collect different kinds of data. A *microscope* is a tool that is used to magnify the features of an object. A *compound microscope* has two or more lenses. Other parts of a compound microscope are:

- *Eyepiece*—contains the a 10X magnifying lens
- *Coarse adjustment knob/focus*—focuses the image under low power
- *Fine adjustment knob/focus*—focuses the image under high power
- *Objective lenses*—two or three separate lenses that contain varying powers of magnifying lenses
- *Stage and stage clips*—supports and hold the microscope slide in place while viewing
- *Diaphragm*—controls the amount of light available
- *Light source*—a mirror, external or internal light source that shines light through the object being viewed
- *Arm*—supports the body tube which connects the eyepiece to the set of objective lenses
- *Base*—supports the microscope

It is essential for students to use the microscope safely and accurately.

- When looking through a microscope, the lighted area is the *field of view*.
- Adjust the diaphragm until an adequate amount of light available.
  - To make the field of view brighter, open the diaphragm.
  - To make the field of view darker, close the diaphragm.
- To view an object under the microscope, first focus on the lowest power objective lens. Then change to the highest power objective lens if necessary.
- When focusing the image under low power objective, use the coarse adjustment knob.
- Use only the fine adjustment knob to sharpen the focus when using the high power objective.
- To calculate the magnification of objects seen through a microscope, multiply the magnification of the eyepiece times the magnification of the objective lens being used.
- Objects on the slide move in the opposite direction when being viewed through the eyepiece (for example, if the slide is moved to the left, the object being viewed appears to move to the right).

It is essential for students to use care when handling the microscope.

- A microscope should be held and carried with one hand under the base and one hand on the arm.
- Some microscopes may have a mirror as the light source. Care should be taken not to aim the mirror directly at the Sun.

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7-1 The student will demonstrate an understanding of technological design and scientific inquiry, including the process skills, mathematical thinking, controlled investigative design and analysis, and problem solving.

It is also essential for students to use tools from previous grade levels that are appropriate to the content of this grade level such as eyedroppers, magnifiers (hand lenses), rulers (measuring to millimeters), thermometers (measuring in ^{o}F and ^{o}C), beakers (measuring to milliliters), forceps/tweezers, graduated cylinders (measuring to milliliters), meter sticks and meter tapes (measuring in meters, centimeters, or millimeters), compasses, timing devices (measuring in minutes and seconds), 10X magnifiers, or beam balances (measuring to centigrams) to gather data.

NOTE TO TEACHER: See information in previous grades regarding how to use each tool. All temperature readings during investigations will be taken using the Celsius scale unless the data refers to weather when the Fahrenheit scale is used.

It is not essential for students to use other types of microscopes or know how to prepare a wet mount slide. Tools from previous grades that are not appropriate to the content of this grade level are not essential; however, these terms may be used as distracters (incorrect answer options) for assessment, for example rain gauge, measuring cups, graduated syringes, tuning forks, anemometers, plane mirrors, prisms, barometers, sling psychrometers, and spring scales. Students do not need to convert measurements from English to metric or metric to English.

Assessment Guidelines:
The objective of this indicator is to *use* tools safely, accurately, and appropriately when gathering data; therefore, the primary focus of assessment should be to apply correct procedures to the use of a microscope and other tools essential to the grade level that would be needed to conduct a science investigation. However, appropriate assessments should also require students to *identify* appropriate uses for a microscope; *illustrate* the appropriate tool for an investigation using pictures, diagrams, or words; *recall* how to accurately determine the measurement from the tool; or *recognize* ways to use science tools safely, accurately, and appropriately.